

Signs of nutrient deficiency

Healthy plants

A healthy plant is characterised by good size, deep green leaves and good all round development. The plant should look vigorous and healthy at all stages of its development, with evenly coloured green leaves (unless a variegated or patterned variety), strong, sturdy stems, normal sized flowers and fruits in normal abundance.



This information sheet is supported by three video clips found on the last slide of **Analytical services for growers**

Primary nutrients

Nitrogen deficiency results in very stunted, spindly yellow plants or yellow leaves, sometimes with pink tints. There is a general yellowing of older leaves (bottom of plant). The rest of the plant is often light green. Visual symptoms are seen first on older leaves as a yellowing (chlorosis) from the leaf tip and along the midrib, whilst the edges remain green. The growth becomes stunted with spindly stalks. Flowers are produced. (Note: in sulfur deficiency yellowing occurs first in the younger leaves).

Phosphorus deficiency results in slow growth and dull yellow-green foliage. Plants remain a very poor size. Leaf tips look burnt, followed by older leaves turning a dark green or reddish-purple, eventually developing necrotic tissue (dead patches). Symptoms are seen as reddening of stems, very stunted growth and poor rooting. Flowers are produced, but there are low fruit yields.

Potassium deficiency results in very stunted plants with yellow or purple leaf-tints, browning at the leaf edge and poor flowering or fruiting. Older leaves may wilt, look scorched. Interveinal chlorosis (yellowing) begins at the base, scorching inward from leaf margins. Symptoms are first seen on older leaves as a drying of leaf tips and along the leaf margins, followed by death of leaf tissues (necrosis). Poor disease resistance and an increase in the plant's susceptibility to drought, lodging and plant pathogens are also seen.

Secondary nutrients

Calcium deficiency results in distorted or irregularly shaped new leaves (top of plant). The leaf margins and tips become necrotic. Blossom-end rot develops. Growth is only slightly affected at first, but eventually stops as necrotic tissue appears at the growing points.

Magnesium deficiency results in yellowing between the leaf veins, sometimes with reddish brown tints and early leaf fall. Not so stunted as major nutrient deficiencies. Older leaves turn yellow at edge, interveinal chlorosis causes green arrowhead shapes or marbling in the centre of the leaf (speckling in cereals). Necrotic tissue develops across the leaves and at the margins. The plant moves its magnesium to growing tissues, so deficiency always appears first in older leaves. This eventually leads to a shedding of leaves, but the plant is able to flower. Magnesium deficiency is common in tomato, apple, grape, raspberry and rose plants.

Sulfur deficiency results in younger leaves turning yellow first, sometimes followed by older leaves. Small, stunted plants are produced. This should not be confused with nitrogen deficiency, which appears first on older leaves and then spreads to the whole plant.

Micronutrients

Boron deficiency results in reasonable size being attained, but death of growing points, so flowers and fruits fail to develop. There is rotting and hollowing of roots and leaves become misshapen. Stunted growth and tip dieback occurs on lettuce; brown cracks in celery; rotten swedes, turnips and celeriac, and dimples in pears with brown patches underneath.

Copper deficiency results in dark green leaves and stunted plants. Cereals show whitening of young leaf tip with the leaves twisting in spirals and bent over at right angles to the stem. Ears may be malformed and underdeveloped and appear white at harvest; sometimes trapped within the leaf sheath.

Iron deficiency results in yellowing between the leaf veins of young leaves. Browning of leaf edges also occurs in acid-loving plants.

Manganese deficiency results in dead spots or patches. Yellowing between the leaf veins of young leaves, with browning of leaf edges on acid-loving plants is observed. The pattern is not as distinct as with iron. Palm fronds are stunted and deformed, called "frizzle top." There is a general reduction in size of plant parts (leaves, shoots, fruit). Symptoms typically appear as a speckling and mottled appearance, usually seen on the younger (upper) leaves, which then develop into necrosis.

Molybdenum deficiency results in a general yellowing of older leaves (bottom of plant). The rest of the plant is often light green. There are elongated twisted leaves on cauliflowers or other brassicas (cabbage family) growing in alkaline soil. Molybdenum deficiency is normally seen in cauliflowers and brassicas, particularly when growing in insufficiently alkaline soil.

Zinc deficiency results in stunted growth and small leaves ('little leaf'). There is general yellowing of older leaves (bottom of plant). The rest of the plant is often light green. Symptoms seen as stunted plants showing a bleaching that can spread to the veins but the midrib and leaf edges remain green. Symptoms appear on older leaves first (unlike sulfur deficiency).

Finding out

There are many reasons for monitoring germination and the growth of plants:

- Healthy growth means quality crops in good yield. It depends on a sufficient supply of essential nutrients. Nutrient deficiencies can be detected from the appearance of the plant. So the appearance of a plant can indicate insufficient nutrients.
- Nutrient deficiencies are often overcome by using fertilisers. The effectiveness of fertilisers can be determined by monitoring plant growth.
- Plants are indicators of environmental pollution, so monitoring them gives useful information about habitats, ecosystems and environments.

Whether checking on nutrients or on the uptake of other chemical compounds by plants, there are general procedures that can be used or modified for use.

Design a series of experiments to investigate the effect of nutrient deficiencies on plant growth.



Figure When designing an experiment to monitor the effect of nutrients on plant growth there are potentially five considerations:

- choice of germinating and growing media;
- choice of containers and conditions;
- choice of seeds and plants;
- observations to be made;
- measurements to be made.

Cucumber

Nitrogen Deficiency

Failure of adequate amounts of nitrogen causes bleaching of older leaves, impaired plant development, delayed growth, thin stems, and distorted and discolored fruit. In severe cases, the whole plant collapses. Nitrogen deficiency may render the cucumber plant very sensitive to salinity.

Phosphorus Deficiency

Phosphorus deficient plants have weak roots, are stunted, and produce small, dark, dull, gray-green leaves. The oldest leaf, at the base of the shoot, turns bright yellow. However, unlike nitrogen deficiency, the leaf directly above this leaf remains dark green. Brown patches appear between veins on mature leaves. These become scorched and spread until the leaf dies prematurely. Fruit set is reduced, so production is impaired until the deficiency is corrected.

Potassium Deficiency

Symptoms of potassium deficiency first appear on older leaves. Typically, chlorosis first appears at the leaf margins, then, the interveinal area is affected. The symptoms progress from the base towards the apex of the plant. Yellowing and scorching of the older leaves begins at the edges and eventually spreads between the main veins towards the center of the leaf. The plant is stunted with short internodes and small leaves.

Corn

Nitrogen Deficiency

Nitrogen (N) deficiency makes the older leaves (the bottom portion of the corn plant) turn pale or yellowish-green. The deficiency then starts to create a V shape, starting at the tip of the leaf. If the problem continues, the deficiency works its way up the plant from older to newer leaves. The stalks tend to be thin and spindly. N deficiency develops commonly in wet to saturated soils or under cool soil temperatures in the spring. N can leach out with heavy rainfall in light-textured (sandy) soils or can be denitrified in flooded soils when temperatures are warm. N deficiency can be induced after midseason or during other periods when soils tend to be dry. N deficiency can also occur in soils with large amounts of low-nitrogen-containing residues.

Phosphorus Deficiency

Phosphorus (P) deficiency causes a distinct dark green with reddish to purplish leaf margins, typically starting from the tip. The deficiency is observed in the older leaves. Stunted growth is also typical. At early development stages some hybrids show purple colors even though P is not deficient, while other hybrids might not show this coloration even when P levels are limiting. P deficiency symptoms normally disappear by the time the plant is waist-high. Since P is fairly immobile in the soil, any soil condition that limits root growth (cool temperature, wet or very dry conditions, compaction) can induce the deficiency.

Potassium Deficiency

Potassium (K) deficiency is observed as yellowing and necrosis (death) of the edge of older leaves. When the problem persists, this deficiency will continue to move up from older to newer leaves, while the top leaves may look completely green. K deficiency can cause lodging of the crop later in the season because stalks are thin and not strong. As with P, soil conditions that restrict root growth can induce deficiency, especially at early stages of development when the root system is small. Soils with low K buffer capacity can cause the deficiency if an appropriate fertilization plan is not followed.